ESTABLISHMENT OF AN INTERVENTION HEALTH EDUCATION PROGRAM FOR ENVIRONMENTAL, HEALTH PROMOTION OF ALUMINUM WORKERS

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ABSTRACT

Even though aluminum is not considered to be a heavy metal like lead, it can be toxic in excessive amounts and even in small amounts if it is deposited in the brain. Many of the symptoms of aluminum toxicity mimic those of Alzheimer's disease and osteoporosis. Colic, rickets, gastrointestinal problems, interference with the metabolism of calcium, extreme nervousness, anemia, headaches, decreased liver and kidney function, memory loss, speech problems, softening of the bones, and aching muscles can all be caused by aluminum toxicity.

This study included 40 workers in an aluminum factory in 6th October District in Egypt with mean aluminum concentration in the different departments in the factory was within permissible exposure level "PEL". Data were collected through a previously prepared questionnaire which consists of three parts. The first part was concerned with demographic data such as age and nationality. The second part was concerned with occupational data such as working hours, working years, smoking, and diseases. The third part concerned with knowledge, attitude and practice about aluminum hazards. The studied workers have reported the exposure to aluminum inside workplace during polishing and during smelting (85 % and 82.5 % respectively). However, majority of workers also reported an extra workplace exposure to aluminum with most of them in form of using alum. Utensils followed by use of food additives containing aluminum (72.5 % and 70 % respectively).

By implementing the intervention study through the comprehensive health education program to workers in the factory, there was a statistically significant reduction in the mean serum aluminum before and after intervention (13.95 and 13.75 up/dl respectively) (*P<0.01*).

Also, the intervention study has improved significantly the knowledge of workers toward the use of PPD by 45.5 % (*P<0.01*).

At the same time, the knowledge of workers toward the exposure to the extra work sources of aluminum was significantly improved as regards aluminum Contained medications and aluminum Containing deodorants by 50 % and 62.5 % respectively (*P<0.01*).

Finally Special safety precautions and educational programs are also needed to limit the aluminum exposure in this industrial group.

Key words: aluminum, workers, educational programs.

INTRODUCTION

Even though aluminum is not considered to be a heavy metal like lead, it can be toxic in excessive amounts and even in small amounts if it is deposited in the brain. Many of the symptoms of aluminum toxicity mimic those of Alzheimer’s disease and osteoporosis. Colic, rickets, gastrointestinal problems, interference with the metabolism of calcium, extreme nervousness, anemia, headaches, decreased liver and kidney function, memory loss, speech problems, softening of the bones, and aching muscles can all be caused by aluminum toxicity **(Gupta *et al.*, 2005).**

Aluminum is excreted by the kidneys; therefore toxic amounts can impair kidney function. Aluminum can also accumulate in the brain causing seizures and reduced mental alertness. The brain is normally protected by a blood-brain barrier, which filters the blood before it reaches it. Elemental aluminum does not pass easily through this barrier, but certain compounds contained within aluminum, such as aluminum fluoride do. Interestingly, many municipal water supplies are treated with both aluminum sulfate and aluminum fluoride. These two chemicals can also combine easily in the blood. Aluminum fluoride is also poorly excreted in the urine.

When there is a high level of absorption of aluminum and silicon, the combination can result in an accumulation of certain compounds in the cerebral cortex and can prevent nerve impulses being carried to and from the brain properly. Long term calcium deficiency can further aggravate the condition. Workers in aluminum smelting plants on a long term basis, have been know to experience dizziness, poor coordination, balance problems and tiredness. It has been claimed that the accumulation of aluminum in the brain could be a possible cause for these issues.

It is estimated that the normal person takes in between 3 and 10 milligrams of aluminum per day. Aluminum is the most abundant metallic element produced by the earth. It can be absorbed into the body through the digestive tract, the lungs and the skin, and is also absorbed by and accumulates in the bodies tissues. Aluminum is found naturally in our air, water and soil. It is also used in the process of making cooking pots and pans, utensils and foil. Other items such as over the counter pain killers, anti-inflammatory products, and douche preparations can also contain aluminum. Aluminum is also an additive in most baking powders, is used in food processing, **(FAO/WHO,2006)** and is present in antiperspirants, toothpaste, dental amalgams, bleached flour, grated cheese, table salt, and beer, (especially when the beer is in aluminum cans). The biggest source of aluminum, however, comes from our municipal water supplies. Excessive use of antacids is also a common cause of aluminum toxicity in this country, especially for those who have kidney problems. Many over the counter type antacids contain amounts of aluminum hydroxide that may be too much for the kidneys to handle properly ***(*****ATSDR, 2006*****).*** Agency for Toxic Substances and Disease Registry.

STUDY HYPOTHESIS

The main hypothesis for the present study implies that workers in aluminum industry are exposed to aluminum during their work. This exposure is occupational in nature and is being associated with health risk factors.

It is postulated that duration of exposure expressed in terms of exposure years is associated significantly with aluminum level. Furthermore, aluminum level is associated significantly with the practice attitudes, perception and knowledge of occupational risks.

OBJECTIVE

Improve quality of life and reduction in the rate of morbidity due to aluminum exposure.

AIM OF THE WORK

Establishment of an intervention health education program for environmental, health promotion of Aluminum workers in 6th of October Factory for Aluminum production.

SUBJECTS & METHODS

Place of the Study: 6th of October factory in Abbasia industrial zone, Cairo, Egypt.

Subjects:

- All workers exposed to aluminum in the factory more than one year will be invited to participate in this study.
- Excluding chronic chest disease and workers work less than one year.
- Administrators of the factory (policy makers).

Methods:

- Pre-intervention.
- Checklist (physical, mechanical and chemical environment)-protective clean clothes-primary medical and periodic examination.
- Interview questionnaires (Age, sex, socio-economic status and educational level).
- Evaluation of the knowledge attitudes and behavior of the workers regarding the hazards of working in Aluminum industry.
- Lab investigations (serum) and aluminum dust in workplace.

Study Design: Intervention design.

Sampling Frame: Forty participants were chosen to participate in the present study

Sampling Technique:

Ethical Issues: The respondents gave their verbal and signed consent to participate in this study .Pre-testing of the questionnaire was conducted on 10 workers before running the study to check its validity; necessary changes were made after testing.

Occupational Data: Occupational and demographic data for participants were obtained through prepared questionnaire.

The first set of questions in the questionnaire determine the demographic data of the participants under this study includes age, gender, smoking habits, type and place of occupation, and duration of employment. The second set the questions include working type, job type, use of personal protective equipment such as mask, gloves and lab-coat, diseases such as sensitivity, urinary tract infection and the perception of participants for occupational dangers associated with their job .

Aluminum Measurement:

The concentration of Aluminum sample was analyzed by atomic absorption spectrophotometer (AAS) which allow for the measurement of a wide range of concentrations of metals in biological samples. The atomic absorption $\max_{0\leq x\leq 1} xe^{-x^2}$spectrometer

Service: Analytikjena

Technique: Graphite tube technique

Source: ContrAA700 is used a Xenon short- arc lamp

High radiation density throughout the entire spectral range (185 - 900nm)

- Data for graphite tube
  - Type of sample Liquid.
  - Inert gas Argon 4.8 and superior permitted component

    O_2 <= 3 ppm
    N_2<= 10 ppm
    Hydrocarbon <= 0.5 ppm
    Humidity <= 5 ppm
  - Inlet pressure 0.6 to 0.7 µpa

- ContrAA700 device consists of the following basic modules
    - Light source
    - Atomizer
    - Detector
    - Mono chromator
    - Evaluation unit
- Function of design of the ContrAA700

The measuring principle of both high resolution continuum source atomic absorption spectrometry (HR - CS - AAS) and classical line source atomic absorption is based.

On the absorption of primary radiation by analyteatoms in their ground state. The measure absorbance signal constitutes a measure of concentration of the respective element in the analyzed sample.

Al – determine.

Atomic spectroscopy support.

Al determination in serum with GF.AAS.

A method is proposed for Al determination in serum by graphite furnace. AAS with transversal heated furnace atomies and Zeeman Effect background correction.

Standard modifier and sample preparation standard solution have been prepared at 0.25 50, 100 µg/L in HNO3 0.2% V/V by serial dilution of 100 µg/L Al single element standard solution.

The modifier 0.2% Mg(NO3)2 and 0.05 % W/V Triton X-100 has prepared by dilution 1.5 ml of 1% µg solution and 0.025g of Tritonx to 50 ml with ultrapure H2O.

For analyses, standard and sample are diluted 1+1 V/V with the modifier solution. Instrumental parameters and HGA program:

- Wave length 309.3 nm slit 0.7 low.
- Lamp current 25 µA (Hcl lamp).
- Background correction Zeeman effect.
- Signal acquisition peak are.
- Calibration Linear std1= 25.0, std2 = 50.0, std3 = 100.0 µg/L.
- Sample and standard volume 10 µl.
- Internal gas argon as standard Air/Oxygen.

Sample collection (Aluminum Dust) and preparation:

Dust samples were collected from the surfaces of abrasives, brushing, packing and inventory.

The samples were homogenized and mixed.

Digestion Methods:

<u>Method A: Hot Plate Aqua-regia Digestion:</u>

1g of a well homogenized sample obtained from a Kjeldahl flask and 12 ml of freshly prepared aqua regia (3ml HNO_3 + 9ml HCl i.e. ratio 1:3) was added. The beaker was covered and the contents heated for 2 hours on the medium heat of a hot plate. The mixture was allowed to cool and then filtered through aWhatmanno.42 filter paper into a 50ml with de-ionized distilled water. Blank solutions were also prepared (Adaramodu *et al*., 2012).

- Intervention Program:

- Health education program for workers was done twice / week. Each cession two hours started from January 2012 till April 2012 (36 days and 72 hours) using flyer (Annex).

- Post-intervention
  - Checklist (physical, mechanical and chemical environment)-protective clean clothes-primary medical and periodic examination.
  - Interview questionnaires.
  - Lab investigations (serum) and aluminum dust in work place.
- Data entry using Epi Info 6.04 (CDC).
- Data Analysis will be SPSS package Ver. 16 (2007).

Statistical Analysis:

The data obtained from analysis of the serum of the subject investigated in this study regarding the concentration of the heavy metals and the associated factors demographically and environment of work were presented as: frequency, package for the social sciences SPSS (version 16, SPSS, an IBM Company, Chicago, USA). P value of ≤ 0.05 was considered statistically significant in the results percentage and T test using statistical.

RESULTS

This study included 40 workers in an aluminum factory in 6th October District in Egypt with mean aluminum concentration in the different departments in the factory was within permissible exposure level "PEL" according to environmental law 4 / 1994 With amendments. (Table 1).

All workers were male gender with mean age 37.7±12.5 years, majority of them were married 77.5% and had a technical school graduation 40%. The overall prevalence of smoking was 22.5 % for cigarettes and 7.5 % for Shisha smoking (Table 2).

Regarding occupational history of studied workers, majority of them were working polishers in polishing department (27.5 %) with small number of them have a work shift (7.5 %) of a mean duration of 9.2±0.7 hours. Majority of workers (92.5 %) were reporting the availability of personal protective devices "PPD", though only 70 % of them were using it and only 55 % of them were beloved the usage of PPD. (Table 3)

The studied workers have reported the exposure to aluminum inside workplace during polishing and during smelting (85 % and 82.5 % respectively). However, majority of workers also reported an extra workplace exposure to aluminum with most of them in form of using alum. Utensils followed by use of food additives containing aluminum (72.5 % and 70 % respectively) (Table 4).

By implementing the intervention study through the comprehensive health education program to workers in the factory, there was a statistically significant reduction in the mean serum aluminum before and after intervention (13.95 and 13.75 ug/dl respectively) ($P<0.01$) (Table 5).

Also, the intervention study has improved significantly the knowledge of workers toward the use of PPD by 45.5 % ($P<0.01$) (Table 6).

At the same time, the knowledge of workers toward the exposure to the extra work sources of aluminum was significantly improved as regards aluminum Contained medications and aluminum Containing deodorants by 50 % and 62.5 % respectively ($P<0.01$) (Table 7).

Additionally, the knowledge of workers toward the general hazardous effect of aluminum was significantly improved 85.7 % (*P<0.01*). The knowledge toward specific hazardous effects of aluminum was significantly improved mostly for causing bronchial asthma and contact dermatitis (71.4 % and 62.5 % respectively) followed by Alzheimer, anemia and osteoporosis (50 %, 25 % and 9.1 % respectively) (*P<0.01*). (Table 8).

Regarding knowledge of workers toward methods of prevention of aluminum pre and post-intervention, there was an improvement mostly for health education and usage of PPD (100% for both) followed by removal of sensitive workers and isolation or substitution (55.6 % and 44.4 %respectively) (*P<0.01*). (Table 9)

Table (1): Aluminum Exposure in work place.

Department	Concentration	PEL
Abrasives	**0.007**	**5 mg / m^3**
Brush for polishing Alum.	**0.006**	
Packing	**0.005**	
Inventory	**0.0036**	

Table (2): Demographic characteristics of studied workers

Basic demographic characteristics		N.	Percent (%)
Gender	**Male**	**40**	**100**
Age (years)	**Mean ± SD (Range)**	**37.7±12.5 (15-62)**	
Marital status	**Single**	**9**	**22.5**
	Married	**31**	**77.5**
Education	**Read and write**	**10**	**25.0**
	Primary	**4**	**10.0**
	preparatory	**7**	**17.5**
	University	**1**	**2.5**
	Technical school	**16**	**40.0**
Cigarette smoking		**9**	**22.5**
Shisha smoking		**3**	**7.5**

Table (3): Basic occupational history of studied workers

Basic occupational history		N.	Percent (%)
Current occupation	**1-Polisher**	**11**	**27.5**
	2- Work in abrasive	**6**	**15.0**
	3- Lather	**5**	**12.5**
	4- work in finishing	**1**	**2.5**
	6- Worker	**3**	**7.5**
	7-Riveter	**1**	**2.5**
	8- Storekeeper	**4**	**10.0**
	9-Packer	**1**	**2.5**
	11- Press stud	**6**	**15.0**
Department	**1- Polishing**	**11**	**27.5**
	2- Abrasive	**5**	**12.5**
	3- Lathing	**5**	**12.5**
	4-Finishing	**3**	**7.5**
	5- Stocks	**6**	**15.0**
	6- Compressor	**6**	**15.0**
	7- Rivet	**2**	**5.0**
work shift		**3**	**7.5**
Mean work shift duration ± SD		**9.2±0.7 hours per shift**	
Previous occupation	**1-Works in all department**	**1**	**2.5**
	1 Polisher	**12**	**30.0**
	2 Work in abrasive	**3**	**7.5**
	3Lather	**4**	**10.0**
	4 work in Sinification	**3**	**7.5**
	5.Incharge of production	**1**	**2.5**
	6 Worker	**1**	**2.5**
	7 Riveter	**1**	**2.5**
	8.Sore keeper	**4**	**10.0**
	9.Packer	**1**	**2.5**
	1- Press stud	**5**	**12.5**
PPD	**Availability**	**37**	**92.5**
	Usage	**28**	**70.0**
	Believe of PPD use	**22**	**55.0**

Table (4): Sources of exposure to aluminum

Exposure to aluminum		**N.**	**Percent (%)**
Exposure outside workplace	Use of alum. containing medications	9	22.5
	Use of alum. utensils	29	72.5
	Use of alum. foil	15	37.5
	Use of food additives containing aluminum	28	70
	Use of aluminum containing deodorant	8	20
Exposure inside workplace	During polishing	34	85
	During smelting	33	82.5

Table (5): Comparison of mean serum aluminum pre and post-intervention

Serum aluminum	**Mean**	**SD**	**t**	**P value**
Baseline	13.95	6.41	3.835	0.000
After intervention	13.75	6.37		

Table (6): Comparison of PPD usage pre and post-intervention

PPD use			**Post-Intervention PPD use**		**Total**	**McNemar Test**	**P value**
			No	**Yes**			
Pre-Intervention	No	N.	6	5	11	1.380	0.002
		Raw %	54.5%	45.5%	100.0%		

Table (7): Comparison of knowledge regarding extra workplace exposure to alum pre and post-intervention

Alum. contained medications (Knowledge)			**Post-Intervention**		**Total**	**McNemar Test**	**P value**
			No	**Yes**			
Pre-Intervention	No	N.	4	4	8	5.367	0.000
		Raw %	50.00%	50.00%	100.00%		
Alum. contained medications (attitude)			Post-Intervention		Total	0.692	0.001
			No	Yes			
Pre-Intervention	No	N.	6	4	10		
		Raw %	60.00%	40.00%	100.00%		
Alum. Containing deodorants			Post-Intervention		Total	16.628	0.000
			No	Yes			
Pre-Intervention	No	N.	3	5	8		
		Raw %	37.50%	62.50%	100.00%		

Table (8): Comparison of knowledge of hazard of exposure to aluminum pre and post-intervention

Health effect			**Post-Intervention**		**Total**	**McNemar Test**	**P value**
			No	**Yes**			
Pre-Intervention	No	N.	1	6	7	8.808	0.001
		Raw %	14.3%	85.7%	100.0%		
Contact dermatitis			Post-Intervention		Total	5.846	0.000
			No	Yes			
Pre-Intervention	No	N.	3	5	8		
		Raw %	37.5%	62.5%	100.0%		
Bronchial asthma			Post-Intervention		Total	7.871	0.000
			No	Yes			
Pre-Intervention	No	N.	2	5	7		
		Raw %	28.6%	71.4%	100.0%		
Anaemia			Post-Intervention		Total	6.407	0.000
			No	Yes			
Pre-Intervention	No	N.	12	4	16		
		Raw %	75.0%	25.0%	100.0%		
Renal failure			Post-Intervention		Total	2.976	0.002
			No	Yes			
Pre-Intervention	No	N.	29	0	29		
		Raw %	100.0%	0.0%	100.0%		
Osteoporosis			Post-Intervention		Total	0.114	0.002
			No	Yes			
Pre-Intervention	No	N.	20	2	22		
		Raw %	90.9%	9.1%	100.0%		
Alzheimer			Post-Intervention		Total	12.037	0.000
			No	Yes			
Pre-Intervention	No	N.	4	4	8		
		Raw %	50.0%	50.0%	100.0%		

Table (9): Comparison of knowledge regarding method of prevention of aluminum pre and post-intervention

Isolation And Substitution			**Post-Intervention**		**Total**	**McNemar Test**	**P value**
			No	**Yes**			
Pre-Intervention	No	N.	5	4	9	0.057	0.002
		Raw %	55.6%	44.4%	100.0%		
Removal of sensitive workers			Post-Intervention		Total	1.021	0.003
			No	Yes			
Pre-Intervention	No	N.	4	5	9		
		Raw %	44.4%	55.6%	100.0%		
PPD			Post-Intervention		Total	0.670	0.000
			No	Yes			
Pre-Intervention	No	N.	0	1	1		
		Raw %	0.0%	100.0%	100.0%		
Health education			Post-Intervention		Total	0.354	0.006
			No	Yes			
Pre-Intervention	No	N.	0	1	1		
		Raw %	0.0%	100.0%	100.0%		

Discussion:

The present study was conducted to achieve the following objectives: to determine the prevalence of aluminum toxicity among workers in aluminum industry and to correlate the occupational exposure for aluminum with diseases such as respiratory diseases and hypersensitivity.

By implementing the intervention study through the comprehensive health education program to workers in the factory, there was a statistically significant reduction in the mean serum aluminum before and after intervention (13.95 and 13.75ug/dl respectively) ($P<0.01$).

Compared with other studies, the aluminum workers are considered at lower exposure level. Halina *et al*., (2001) reported in his study that prior to employment in the pot room, workers' mean serum aluminum level was 3.37 .A steady increase of serum aluminum over time was observed with mean concentration almost doubling at the 12 month Stage, followed by a period levelling off. In another study conducted by Drabløs *et al*., (1992), the mean urine aluminum level of 15 workers in an aluminum fluoride plant exposed to a mean of 0.12 mg Al/m3 was 12µg/L, of 12 potroom workers in an aluminum smelter exposed to a mean of 0.49 mg Al/m3 was 54µg/L and 7 foundry workers in the aluminum smelter exposed to a mean of 0.06 mg Al/m3 was 32µg/L; that for the 230 controls was 5µg/L.

The data showed that using the following protective tools hearing tools, eye glasses, head cap, welding glass and face mask, was shown to retain the aluminum concentration below the average (p value <0.05 for all). It is required to reduce the exposure to aluminum. According to the requirements of the U.S. Occupational Safety and Health Administration (OSHA), employers have to reduce exposures to aluminum (NIOSH, 2005).

The data of the present study showed that exposure to aluminum dust has similar distribution among participants with various aluminum concentrations and this was with permissible exposure level. Other studies across the literature showed that the pot emissions contained various chemicals among which are aluminum oxide, carbon dusts, particulate polycyclic organics, gaseous and particulate fluorides, carbon monoxide, carbon dioxide, Sulphur dioxide and nitrogen oxides. These chemicals reflect increased exposure to aluminum, (Yokel *et al.*, 2008).

The other variables in this section such as welding gases, organic solvents, metals, noise contamination, cold/heat stress, stress at work environment, waste management and hobbies follow the same pattern of discussion. In these cases, we think that participants are still having high exposure even below the average and that is why no significant differences have been observed. These findings do not agree with other studies conducted in animals in which it has been suggested that maternal stress during pregnancy could enhance aluminum induced developmental toxicity in mouse and rat offspring (Colomina *et al*., 2005); (Roig *et al*., 2006).

At the same time, the knowledge of workers toward the exposure to the extra work sources of aluminum was significantly improved as regards aluminum Contained medications and aluminum Containing deodorants by 50 % and 62.5 % respectively ($P<0.01$).

Additionally, the knowledge of workers toward the general hazardous effect of aluminum was significantly improved 85.7 % ($P<0.01$). Regarding the knowledge toward specific hazardous effects of aluminum was significantly improved mostly for causing bronchial asthma and contact dermatitis (71.4 % and 62.5 % respectively) followed by Alzheimer, anemia and osteoporosis (50%, 25 % and 9.1 % respectively) ($P<0.01$). This was in agreement with evidence suggests that wellness programs that emphasize correcting workplace hazards show greater participation rates than those that focus on individual behavior change alone (Sorensen and Barbeau 2004). Therefore, wellness programs may have a greater chance of success if integration with occupational health and safety (OHS) efforts is a priority. Furthermore, to truly promote worker health, OHS cannot be ignored.

Regarding knowledge of workers toward methods of prevention of aluminum pre and post-intervention, there was an improvement of usage of PPD (100% for both) followed by removal of sensitive workers and isolation or substitution (55.6 % and 44.4 % respectively) ($P<0.01$). This was in agreement with workplace wellness or health promotion programs are a combination of educational and organizational activities designed to support healthy lifestyles. These programs consist of health education, screening, and interventions designed to change workers' behavior in order to achieve better health. Workplace wellness/health promotion has been defined as "the combined efforts of employers, employees, and society to improve the health and well-being of people through activities that target individual lifestyles.

Occupational Health and Safety with Workplace Wellness Programs (2010)

"These programs address specific lifestyle behaviors, not just those at work (NIOSH 2008).

The results of the present study showed that aluminum concentration to be correlated significantly with weekly working hours(8 hours /day) (p value 0.000). It has been realized by the U.S. Occupational Safety and Health Administration (OSHA) that employers have to reduce exposures to aluminum to or below an 8-hr time-weighted average (TWA) of 15 mg/m3 for total aluminum dust or 5 mg/m3 for the repairable fractions (NIOSH, 2005).

According to our study, aluminum workers have high concentrations of serum aluminum compared with other studies, in addition to that the incidence of diseases in relation to exposure is low, simply because: 1- Interview questionnaires may be not a proper way to collect data about diseases. 2- Traditional surveillance approaches used in public health practice are difficult to apply to metals poisoning because adverse health effects related to metal exposure may not be clinically diagnosed, except at very high exposure levels, and are not usually listed as reportable diseases.

Conclusions and Recommendations:

1- The mean concentration of aluminum in study group is 13.8ug/L (max. 34.8).

2- Using protective tools during work reduces the exposure to aluminum.

3- Aluminum concentration is correlated significantly with using personal protective device and increase awarrance about aluminum hazards

To detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

REFERENCES

Agency for Toxic Substances and Disease Registry (2006): A Toxicological Profile for Aluminum. Atlanta, GA.: U.S. Department of Health and Human Services, Tox Guide™ for Aluminum. www.atsdr.cdc.gov/toxpro2.hotml

Colomina M.T, Roig J.L, Torrente M, Vicens P, and Domingo J.L. (2005): Concurrent exposure to aluminum and stress during pregnancy in rats: Effects on postnatal development and behavior of the offspring. Neurotoxicol. Teratol. 27:565-574.

Drabløs P.A, Hetland S, Schmidt F, and Thomassen Y. (1992): Uptake and Excretion of Aluminum in Workers Exposed to Aluminum Fluoride and Aluminum Oxide. Aluminum Association. Aluminum and Health, 2nd International Conference. Tampa, Florida. pp. 157-160.

Ehi-Eromosele CO, Adaramodu AA, Anke W.U C.O, Ajanaku C.O, Edbor-Osoh A (2012): Comparison of three methods of digestion for Trace Metal Analysis in Surface Dust Collected from E-waste Recycling Site.; 10(10).

Emmanuel Delhaize and Peter R, Ryan. (1995): Aluminum Toxicity and Tolerance in Plants. Plant Physio, 107: 31 5-321.

Food and Agriculture Organization/World Health Organization (2006): Summary and conclusions of the sixty-seventh meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA). Guidelines for Integrating.

Gupta, VB, Anitha, S, Zecca, L (2005),. Aluminum in Alzheimer's disease: are we still at a crossroad. Cellular and Molecular Life Sciences, 62:143-158.

Helina B. Ro”llin, Penelope Theodorou, Claudina M.C.A Nogueira and Jonathan Levin (2001): Aluminum uptake and excretion in pot room workers of a new primary aluminum smelter during the construction stage.J.Environ Monit.,3,560-564

National Institute for Occupational Safety and Health. Work Life Initiative (2008): Essential elements for effective workplace programs and policies for improving worker health and wellbeing. http://www.cdc.gov/niosh/worklife/ essentials.html. Accessed 1/12/2010.

National Institute for Occupational Safety and Health. Work Life Initiative. (2008): Essential elements for effective workplace programs and policies for improving worker health and wellbeing. http://www.cdc.gov/niosh/worklife/ essentials.html. Accessed 1/12/2010.

National Institute of Environmental Health Sciences. October (2005): Alzheimer's Disease and aluminum" http://www. niehs.nih.gov/ external/faq/aluminum.htm

National Library of Medicine (2000): Aluminum fluoride, Hazardous Substances Data Base. Washington, DC, National Library of Medicine.

National Institute for Occupational Safety and Health. (2005): Pocket guide to chemical hazards, aluminum.

Occupational Health and Safety with Workplace Wellness Programs (2010): Training and Education Program which is administrated by

Commission on Health and Safety and Workers' Compensation in the Department of Industrial Relations through agreements with the Labor Occupational Health Program at the University of California, Berkeley, the Western Center for Agricultural Health and Safety at the University of California, Davis, and the Labor Occupational Safety and Health Program at the University of California, Los Angeles.

Roig JL, Fuentes S, Colomina MT, Vicens P, and Domingo JL. (2006): Aluminum, restraint stress and aging: behavioral effects in rats after 1 and 2 years of aluminum exposure. Toxicology 218:112-124.

Sorensen G and Barbeau E. (2004): Integrating occupational health and safety and worksite health promotion: state of the science. The National Institute for Occupational Safety and Health Steps to a Healthier US Workforce Symposium Washington, D.C. 88 p. www.atsdr.cdc.gov.

Yokel RA, Hicks CL and Florence RL (2008): "Aluminum bioavailability from basic sodium aluminum phosphate, an approved food additive emulsifying agent, incorporated in cheese". Food and Chemical Toxicology46 (6): 2261-6.

إنشاء برنامج تدخلى للثقافة الصحية لتعزيز المستوى الصحى والبيئى لعمال صناعة الألمونيوم

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المستخلص

بالرغم من ان الألمونيوم لا يعتبر من المعادن الثقيلة لكن له تأثيرات ضارة على الصحة سواء كان بكميات صغيرة او كبيرة يتركز الألمونيوم فى المخ ويؤدى إلى مرض الزهايمر وكثير من الأمراض الأخرى مثل هشاشة العظام – الكساح –مشاكل فى الجهاز الهضمى ويتدخل أيضا فى عمليات الأيض لعنصر الكالسيوم ويؤدى إلى حدوث لين العظام – إجهاد فى العضلات – أنيميا – صداع – ضعف فى وظائف الكبد والكلى تم عمل هذه الدراسة على جميع العاملين فى مصنع ٦ أكتوبر للألمونيوم مع استبعاد الفئات الحساسة من العاملين فى هذا المجال (الذين يعانون من أمراض مزمنة – فترة عملهم تقل عن عام) مع حساب متوسط تركيز الألمونيوم فى دم العاملين حيث أن التعرض كان فى الحدود المسموحة فى جميع ألأقسام طبقا لقانون البيئة ٤ لعام ١٩٩٤ تم جمع البيانات طبقا لإستبيان تم وضعه مسبقا وكان يشمل على ٣ أجزاء الجزء الأول: المعلومات الديموجرافية بالنسبة للعامل (الاسم – السن –الحالة الإجتماعية والإقتصادية – المستوى التعليمى للعامل) الجزء الثانى: (المعلومات الوظيفية (الوظيفة الحالية والسابقة – ساعات العمل) الجزء الثالث: (تقييم مدى الوعى والمعرفة والإتجاهات عن الألمونيوم) وأسفرت نتائج الدراسة أن ٨٥ % من العمال معرضين لغبار الألمونيوم و يعملون فى قسم الفرشة والصنفرة –٧٢،٥% معرضين خارج بيئة العمل اثناء إستعمال أوانى الطهى المصنوعة من الألمونيوم ومكسبات الطعم التى تحتوى على الألمونيوم عند تطبيق البرنامج التدخلى (التثقيف الصحى) والمقارنة قبل وبعد البرنامج وجد إنخفاض واضح فى نسبة الألمونيوم فى دم العاملين ذات أهمية إحصائية وكان متوسط نسبة الألمونيوم فى الدم قبل التدخل ١٣,٩٥% % وبعد١٣,٧٥%

وتحسن واضح أيضا عن أهمية إرتداء ملابس الوقاية الشخصية بنسبة ٤٥,٥% وفى نفس الوقت ازدادت المعرفة عن التعرض للألمونيوم خارج بيئة العمل مثل ألأدوية التى تحتوى على الألمونيوم بنسبة ٥٠% ومزيلات العرق بنسبة ٦٢,٥% طبقا لدراستنا وبالمقارنة بدراسات أخرى وجد إرتفاع فى نسبة الألمونيوم فى دم العاملين المعرضين ولا يوجد علاقة بينه وبين حدوث المرض وذلك لأن:

١- لا يعتبر الاستبيان فقط الطريقة الصحيحة لجمع البيانات عن المرض.
٢- المعتقدات المجتمعية عن المسح للمعادن الثقيلة وخاصة التى تتعلق بالمضاعفات الصحية غير مقبولة ولا يتم تشخيصها إلا إكلينيكيا فى حالات التعرض العالية وأخيرا يجب تطبيق إحتياطات السلامة المهنية وتكثيف برامج التوعية للحد من التعرض للألمونيوم فى المجموعات الصناعية.